

CS98-076  
Serial number 09/262,000

AMENDMENTS

34. Please cancel claim 34.

Please add the following new claim.

37. The method of claim 1 wherein said optical interference multilayer stack is formed by the process of plasma-enhanced chemical vapor deposition.

REMARKS

Examiner J. Vockrodt is thanked for his thorough examination of the Prior Art, he is also thanked for his indication of allowing claims 8-32.

Claims 34 has been cancelled as part of this response, a previous response has mistakenly cancelled claim 3 where claim 34 was meant to be cancelled. The original claim 3 has been specified as the new claim 37.

Favorable reconsideration of this application in light of the above amendments and the following remarks is respectfully requested.

The invention provides five new methods for the formation of an improved liquid-crystal-on-silicon display. The device structure is enhanced by the photolithographic creation of alignment posts among the mirror pixels of the micro-display. The five methods accommodate the fabrication of an optical interference multilayer, which improves the image quality of the reflected light. The five methods of the invention provide:

- silicon dioxide posts by wet etching
- amorphous silicon posts by plasma etching
- silicon nitride posts by plug filling
- insulation material posts by lift-off, and
- polyimide posts by photosensitive etching.

Claim rejections - 35 U.S.C. § 103

1. Reconsideration of the rejection of claims 1-2 and 5-6 under 35 U.S.C 103(a) as being unpatentable over Wong (US 6,027,999) in view of Haskell (US 6,252,999) is respectfully requested based on the following.

Applicant respectfully disagrees with Examiner in Examiner's assertion that Wong et al. teaches the creation of

insulating material alignments posts and quotes from the Wong et al. invention, as follows:

- col. 3, lines 2 e.a.: "vias are opened through the dielectric layer 24 and filled, for example, by a tungsten plug process"
- col. 3, lines 13 e.a.: "a tungsten layer is deposited over the insulating layer and within the via openings and then etched back to form tungsten plugs 38."
- col. 3, lines 22 e.a.: "a thin metal layer is deposited over the insulating layer and tungsten plugs, 36 and 28, respectively"
- col. 3, lines 25 e.a.: "the metal layer is patterned to form the metal pixels 42, as shown in Fig. 4."

A passivation stack is next formed over the metal pixels that rest on the metal alignment posts, the passivation stack comprises a lower layer of passivation (layer 44) and an upper layer of silicon nitride (layer 46). Examiner suggests that these latter two layers form the alignment posts, Applicant respectfully submits that these latter two layers are not the alignment posts but are conventionally provided for the protection of underlying structures, in the case of the Wong et al. invention for the protection of metal alignment posts and metal pixels. Applicant finally refers to claim 1 which specifies the use of "forming insulating material alignment

posts", subsequent dependent claims to claim 1 specify the details of how these insulating material alignment posts are created, providing a process that is at significant variance with the process of Wong et al. since the latter process uses metal for the creation of a reflective plate.

Haskell et al. do not provide for the creation of alignment posts but provide for the creation of a planar, light reflective back-plane. The adjustments that relate to and optimize light reflectivity that are provided by Haskell et al. are therefore part of a structure that has no commonality with the structure of the instant invention. Haskell, in the creation of a planar, light reflective back-plane must address concerns and aspects of light reflectivity since without proper selection of light reflectivity parameters the Haskell invention would be without value. For similar reasons must the instant invention address these concerns but since these concerns of the instant invention apply to a structure that has no commonality with the structure of Haskell et al, the considerations of the two inventions can have only a passing or accidental commonality. This is similar to placing focusing devices, such as a lens, in two different structures. Both structures must address the focusing parameters of the lenses as they apply to a particular structure but it stands to reason that focusing parameters of one structure most

likely have no commonality with focusing parameters of the other and different structure.

In light of the foregoing response, applicant respectfully requests that the Examiner's rejection of claims 1-2 and 5-6 under 35 U.S.C 103(a), be withdrawn.

2. Reconsideration of the rejection of claims 3-4 under 35 U.S.C 103(a) as being unpatentable over Wong (US 6,027,999) and Haskell (US 6,252,999) in view of Lee (US 4,827,870) is respectfully requested based on the following.

The merits of Wong et al. and Haskell with respect to the instant invention have been discussed above.

Lee teaches an apparatus for applying multilayer optical interference coating on complex curved substrates. The Lee method may therefore provide a method for the implementation of the instant invention without however negating the originality of the instant invention. The apparatus that is provided becomes a potential tool for the implementation of the invention but does therefore not affect the instant invention in being original and therefore patentable. Lee uses the process of PECVD for, col. 1, lines 49 e.a.: "The visors and other polymeric

substrates are coated by plasma enhanced chemical vapor deposition (PECVD).” This does not constitute the entire process of forming a multilayer optical interference coating but is only one of the multiple steps that are required in order to complete the Lee process. The Lee process is thereby specifically aimed at creating such an interference coating over polymeric substrates of complex curve topography such as helicopter visors, a processes that requires numerous other processing steps as is clear from the Lee specification. The instant invention, in claims 3 and 4, specifies the formation of an optical interference stack over the surface of a silicon substrate without further providing for a surface of complex or irregular topography. It must finally be pointed out that the optical interference stack of the invention is created in combination with insulating material alignment posts which requires a processing sequence that can be successfully applied to such a structure, just as the Lee invention requires a requires a processing sequence that can be successfully applied to a structure formed over an uneven surface. The process of PECVD is admittedly well known in the art which however does not deny the value of applying this process to a particular processing stream of the instant invention in order to derive and provide for the desired creation of insulating material

alignment posts that are associated with active device structures.

In light of the foregoing response, applicant respectfully requests that the Examiner's rejection of claims 3-4 under 35 U.S.C 103(a), be withdrawn.

3. Reconsideration of the rejection of claim 7 under 35 U.S.C 103(a) as being unpatentable over Wong (US 6,027,999) and Haskell (US 6,252,999) in view of Sato et al. (US 5,379,139) is respectfully requested based on the following.

Sato et al. (US Patent 5,379,139) specifies, col. 3, lines 24 e.a., "the thickness is reduced to less than 3 microns, e.g. 2 +- 0.5 microns, which is suitable ...". Claim 7 specifies a lower limit of 0.3 microns which is considerable lower than the lower limit that is provided by Sato et. al, indicating that the invention allows for the creation of considerably thinner crystal devices, which provides a considerably extended capability in creating thin crystal devices.

In addition, the fact that a device or device feature is created that may or have identical or close to identical physical dimension after the device or the device feature has

been completed has no bearing on the uniqueness of the process that is used for this creation. It is entirely feasible to create two elements that have identical physical dimension upon completion whereby yet the processes that are used for these creations are unique and are therefore each patentable.

In light of the foregoing response, applicant respectfully requests that the Examiner's rejection of claim 7 under 35 U.S.C 103(a) as being unpatentable over Wong (US 6,027,999) and Haskell (US 6,252,999) in view of Sato et al. (US 5,379,139), be withdrawn.

4. Reconsideration of the rejection of claim 34 under 35 U.S.C 103(a) as being unpatentable over Moore et al. (US 6,051,446) in view of Wright et al. (US 5,801,800) is respectfully requested based on the following.

The rejection is considered moot in view of the fact that claim 34 has been cancelled.



Other Considerations

Dependent claim 37 has been written as a result of this office action. Claim 37 is provided to re-institute a previously incorrectly cancelled claim 3. No new charges are therefore incurred due to this office action.

SUMMARY

The invention provides five new methods for the formation of an proved liquid-crystal-on-silicon display. The device structure is enhanced by the photolithographic creation of alignment posts among the mirror pixels of the micro-display. The five methods accommodate the fabrication of an optical interference multilayer, which improves the image quality of the reflected light. The five methods of the invention provide:

- silicon dioxide posts by wet etching
- amorphous silicon posts by plasma etching
- silicon nitride posts by plug filling
- insulation material posts by lift-off, and
- polyimide posts by photosensitive etching.

It is requested that should Examiner not find the claims to be allowable that he call the undersigned Attorney at his convenience at 845-452-5863 to overcome any problems preventing allowance.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned:

"Version with markings to show changes made."

Respectfully submitted,

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